US Army Corps
of Engineers

REVIEW OF AUTOMATED REVIEW MANAGEMENT SYSTEM

by

N. Radhakrishnan

Information Technology Laboratory

DEPARTMENT OF THE ARMY
Waterways Experiment Station, Corps of Engineers
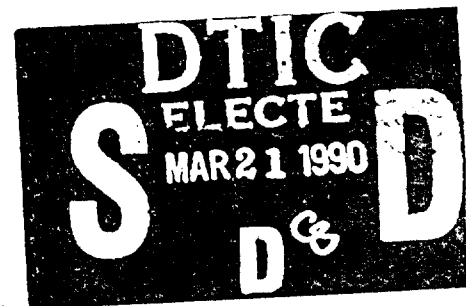3909 Halls Ferry Road, Vicksburg, Mississippi 39180-6199

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The Automated Review Management System (ARMS) was developed by the US Army Construction Engineering Research Laboratory (CERL) in response to a need by Corps of Engineers Project Managers for a tool to assist them in tracking constructibility and design reviews for military construction projects.

The effort reported here explores whether ARMS should be recommended for Corps-wide implementation and, if so, what support mechanism should be provided to the offices. The study was conducted using a field task group consisting of Headquarters, Laboratory, District, and Division members. This approach was chosen to bring balance and realism to the conclusions and recommendations.

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The task group developed the following recommendations:

- The Corps should adopt ARMS as a Corps-wide system to be used in Military Program projects.

- Headquarters should fund a Civil Works district to pilot test ARMS. Based on this pilot test, a decision should be made in fielding ARMS in Civil Works projects.

- CEMP-ES should be designated as Headquarters' proponent of ARMS.

- A small ARMS Support Center consisting of three to five members should be established at the Sacramento District. Care should be taken to see that the support functions of the Center do not conflict or overlap with the operational functions of the Sacramento District.

- Use of ARMS in UNIX-based microcomputers should be further investigated. If successful, many districts may prefer to implement ARMS in this manner. The ARMS Support Center computer should be made available for any district wanting to test ARMS or wanting to use ARMS in a central computer.

- When the Corps' CEAP (Corps of Engineers Automation Plan) computers are fully deployed, ARMS fielding issues should be revisited.

- Every office using ARMS should designate an ARMS Project Coordinator who will take responsibility for the proper use of ARMS in the district's work.

- ARMS should be implemented in a phased manner.

- A new release of ARMS with the inclusion of some of the positive features of the two other existing review management systems (COMNET and DOCFR) should be developed within the next few months.

- A Field Technical Executive Group for computer-aided engineering should be formed to advise Headquarters on interdisciplinary computer application areas. This group should have members from the Civil Works and Military Program Directorates and the field offices.

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EXECUTIVE SUMMARY

The Automated Review Management System (ARMS) was developed by the US Army Construction Engineering Research Laboratory (CERL) in response to a need by Corps of Engineers Project Managers for a tool to assist them in tracking constructibility and design reviews for military construction projects. The results of a Corps-wide survey in 1983 indicated that 56 percent of contract modifications are initiated to correct design deficiencies.

Many of these deficiencies stem from the fact that management of the current Biddability, Constructibility, and Operability review process is difficult for the Project Manager because of time constraints, the lack of an effective way to handle the comments generated by a review, and the lack of a mechanism to effectively monitor the performance of those entities from which a review was requested.

ARMS was designed to improve productivity by supporting the four primary levels of activity in the design review process: Project Manager, Review Manager, Reviewer, and Architect/Engineer. The system accomplishes this by:

- Connecting all participants in the review process via an electronic mail and message system.

- Providing a way for the review participants to enter, store, edit, and transmit comments.

- Providing the capacity to track all elements and phases of the project and to monitor the progress of participating agencies and reviewers.

- Providing for effective management of the entire process at the district level.

ARMS has been tested extensively by the Sacramento District for the past two years and has been prov: · ˉˉːccessful.

If properly implemen · (ARMS can become a valuable asset to Life Cycle Project Management. It can significantly contribute to completing projects on time and within costs, while at the same time providing an audit trail of all comments received and their disposition during the life cycle of the project. Capturing this information in a computer can also aid in analyzing general problem areas encountered in past projects and avoiding these problems in future projects.

The effort reported here explores whether ARMS should be recommended for Corps-wide implementation and, if so, what support mechanism should be provided

to the offices. The study was conducted using a field task group consisting of Headquarters, Laboratory, District, and Division members. This approach was chosen to bring balance and realism to the conclusions and recommendations.

The task group met twice and reviewed ARMS and two other systems being used by the Corps for review management, the COMNET system developed by the Omaha District, and the DOCFR system developed by the Headquarters Medical Review Group. Demonstrations of ARMS and COMNET were also witnessed by the task group.

The task group developed the following conclusions and recommendations.

Conclusions

- The Corps can benefit from an automated review management system.

- An automated review management system can provide optimum benefits only if it is implemented Corps-wide, at least for the Military Program projects.

- Due to the large number of users involved and the varying computer literacy backgrounds, it is imperative that the system be kept very user friendly and training material be prepared that addresses both classroom training as well as other modes of training.

- Headquarters must establish a strong proponency for this task and provide the field with proper guidance on the use of the system.

- A phased implementation of the system is necessary. Further, a Civil-Works-oriented district must be tasked to pilot test the system before adoption in the Civil Works projects.

- While the ARMS system developed by CERL and tested by the Sacramento District appeared as the most promising system, some features of the two other existing systems need to be included.

Recommendations

- The Corps should adopt ARMS as a Corps-wide system to be used in Military Program projects.

- Headquarters should fund a Civil Works district to pilot test ARMS. Based on this pilot test, a decision should be made in fielding ARMS in Civil Works projects.

- CEMP-ES should be designated as Headquarters' proponent of ARMS.

- A small ARMS Support Center consisting of three to five members should be established at the Sacramento District. Care should be taken to see that the support functions of the Center do not conflict or overlap with the operational functions of the Sacramento District.

- Use of ARMS in UNIX-based microcomputers should be further investigated. If successful, many districts may prefer to implement ARMS in this manner. The ARMS Support Center computer should be made available for any district wanting to test ARMS or wanting to use ARMS in a central computer.

- When the Corps' CEAP (Corps of Engineers Automation Plan) computers are fully deployed, ARMS fielding issues should be revisited.

- Every office using ARMS should designate an ARMS Project Coordinator who will take responsibility for the proper use of ARMS in the district's work.

- ARMS should be implemented in a phased manner.

- A new release of ARMS with the inclusion of some of the positive features of the two other existing review management systems (COMNET and DOCFR) should be developed within the next few months.

- A Field Technical Executive Group for computer-aided engineering should be formed to advise Headquarters on interdisciplinary computer application areas. This group should have members from the Civil Works and Military Program Directorates and the field offices.

PREFACE

This report investigates the desirability of fielding an automated review management system in support of Corps projects. The study was triggered by a letter from the Division Engineer, South Pacific Division, asking the Headquarters, US Army Corps of Engineers, to establish a Corps-wide Technical Center of Expertise at the Sacramento District to support a system called ARMS (Automated Review Management System) that was originally developed by the US Army Construction Engineering Research Laboratory (CERL). Mr. Richard Hanson, Acting Director, then Engineering and Construction Directorate (E&CD), and Mr. Herb Kennon, then Chief of the Engineering Division, E&CD (now Chief of Engineering Division, Military Programs Directorate), tasked Dr. N. Radhakrishnan, Chief, Information Technology Laboratory (ITL), US Army Engineer Waterways Experiment Station (WES), to study the issue and make recommendations. The tasking papers are included in Appendix A. The study was performed from 10 July 1989 through 30 September 1989.

The study was conducted using a task group consisting of District, Division, Laboratory, and Headquarters members. The following members constituted the task group:

        Dr. N. Radhakrishnan, CEWES-IM-Z, Chairman

        Mr. Hugh Adams, CEMP-ES

        Mr. Robert Chesi, CEMP-CE

        Mr. Jim Goering, CEMRK-ED

        Mr. Jeff Kirby, CECER-FS

        Mr. Joe Rogers, CESAS-EN

        Dr. Hugh Sharp, CEHND-ED-ES

        Mr. Steve Stoner, CESPK-ED-T

        Mr. Jim Vandersand, CESWF-ED-D

Other members who participated in the deliberations of the task group are:

        Mr. Bruce Dains, CEMP-EM

        Dr. Simon Kim, CECER-FS

        Dr. Ed Middleton, CEWES-IM-D

        Mr. Peter Olcott, CEMRO-ED-M

Mr. Paul Senter, CEWES-IM-Z

Mr. Jerry Smith, CEMRD-ED-C

Mr. Sandy Stevens, CEWES-IM-DA

CONTENTS

REVIEW OF
AUTOMATED REVIEW MANAGEMENT SYSTEM

I. Background

The Automated Review Management System (ARMS) was developed by the US Army Construction Engineering Research Laboratory (CERL) in response to a need by Corps of Engineers Project Managers for a tool to assist them in tracking constructibility and design reviews for military construction projects. The results of a Corps-wide survey in 1983 indicated that 56 percent of contract modifications are initiated to correct design deficiencies.

Many of these deficiencies stem from the fact that management of the current Biddability, Constructibility, and Operability (BCO) review process is difficult for the Project Manager because of time constraints, the lack of an effective way to handle the comments generated by a review, and the lack of a mechanism to effectively monitor the performance of those entities from which a review was requested.

ARMS was designed to improve productivity by supporting the four primary levels of activity in the design review process: Project Manager, Review Manager, Reviewer, and Architect/Engineer. The system accomplishes this by:

- Connecting all participants in the review process via an electronic mail and message system.

- Providing a way for the review participants to enter, store, edit, and transmit comments.

- Providing the capacity to track all elements and phases of the project and to monitor the progress of participating agencies and reviewers.

- Providing for effective management of the entire process at the District level.

ARMS has been tested extensively by the Sacramento District for the past two years and has been proven successful.

Development of ARMS

During the past several years CERL has been working on various aspects of improving the design review procedure. The process has included gathering information about existing district support systems, conducting a workshop at CERL to define automation requirements, and developing and testing the prototype ARMS.

To date these efforts have resulted in the following:

- Revised Engineer Regulation 415-1-11 at CERL's initiation
- Chief of Engineers command emphasis letters
- Prototype test of ARMS Version 1.1 at Omaha District in FY86
- In-progress review of ARMS Version 1.1
- Development of ARMS Version 2.0
- Testing of ARMS Version 2.0 at Sacramento District in FY87
- Sacramento District ARMS test report published 8 January 1988
- Implementation of ARMS Version 2.0 at Sacramento District from FY88 to present
- Establishment of ARMS user's group in FY88
- Development of ARMS Version 3.0

The Sacramento District has been a test district for ARMS. The district uses ARMS successfully for all designs in their large military construction program.

Description of the ARMS Concept

ARMS provides an interactive computer program to facilitate the review process. ARMS electronically connects all design reviewers, the Project Managers, and in-house designers or design architect-engineers (A/E's); it provides a way to enter, store, edit, and send comments; and it can be utilized to track all phases of a project and check the progress of reviewers and designers. ARMS has been using a central computer for storage of review comments, and users can gain access to the system via a modem.

ARMS is actually four separate user systems linked electronically to facilitate the transfer of information. As such, it is organized into four user levels:

Level 1 - Project Management Level

Level 2 - Review Management Level

Level 3 - Reviewer Level

Level 4 - Project A/E Level

Users are routed automatically to the appropriate level based on their role in the review process. Each system level provides a range of functions and capabilities tailored to the particular needs of that level. Details of the program documentation are provided in Kirby et al. (1988).

Sacramento District Experience

A computer network has been established to include the Sacramento District (CESPK), the South Pacific Division (CESPD), the Air Force Regional Civil Engineers-Western Region (AFRCE-WR), the Los Angeles District, major commands, and extending to Army and Air Force installations within the jurisdiction of CESPK's military design effort. This network will process all review comments, including BCO comments on military project designs.

In the past, the process consisted of the various reviewing agencies preparing handwritten or typewritten comments, sending the comments by mail through the appropriate channels to the Sacramento District's Design Quality Assurance (DQA) Section for coordination, annotation, and compilation prior to mailing to the designer for incorporation. This process was, at best, time-consuming, cumbersome, and produced enormous amounts of paper.

The computer network process provides better comment management at all levels of review, eliminates the lengthy mailing periods, aids in the feedback of comment disposition to the reviewers, streamlines the comment processing and retrieval functions, and helps to decrease the number of duplicate comments. The CESPK Engineering Division is responsible for establishing and maintaining the project comment files. CESPD, AFRCE-WR, and major commands are responsible for forwarding project comment files to their reviewers and back to CESPK.

DQA establishes a comment file for a specific project at a specific installation. Only the agencies and district elements having jurisdiction at the installation will have access to the particular file. As the project documents (drawings,

specifications, cost estimates, design analyses) are reviewed, the comments are inserted through a terminal or microcomputer into the project master file. Each comment is coded as it is entered to aid in retrieval at a later date.

At the end of the designated review period, annotations by DQA on each comment as to concur or deny are made. Reasons for comment denial are input, and all reviewers can access the annotations and reasons for denial.

The A/E inputs his responses to the review comments as he completes the next phase of the design. He may elect to rebut some comments. If so, these rebuttals will also be entered into the system and are readily accessible by all reviewers.

Because comments will have been coded by subject, they can be easily retrieved to spot trends of commonly made errors. Hopefully, this aspect will result in clarification of criteria or special instructions to designers and prevent repetitive errors from occurring.

Once the design and reviews are completed and a project is ready to advertise, the project comment file is made available to Construction Division and all reviewers through a "library" for their use during the advertising and construction phases. Following construction completion, tapes will be stored for an appropriate period of time.

The above-described process has proven potential for greatly enhancing effectiveness of the comment review process thereby maximizing the considerable investment of resources by all involved agencies.

The Sacramento District has a large geographical military design area with 34 installations and a large number of projects per year. Some of the advantages with ARMS that the Sacramento District has experienced include:

- Improved communications with design reviewers.
- Reducing the number and cost of design errors during the design phase of a project.
- Gaining insight into the status of user's comments. (This insight is not cost effectively obtainable by any other means.)
- Learning how to do design reviews by using previous reviews available to any ARMS user.
- Providing a comprehensive data base for easily monitoring criteria by subject matter.

Sacramento District's customers have expressed their satisfaction with ARMS. ARMS allows them to:

- Reduce paperwork.

- Retrieve comments quickly and comprehensively.

- Improve communications/feedback and reduce transmittal time.

- See for themselves consistent comment action.

ARMS Advantages

The following benefits are anticipated as a result of implementing the ARMS program by district offices:

- Close tracking of the review process will enable the Project Manager (PM) to know and to respond to the review suspense requirements faster and more efficiently.

- Closer monitoring of the review process by the PM will encourage reviewers to perform at higher, more efficient levels and, therefore, render higher quality reviews.

- The electronic mail feature will facilitate the review process by expediting the return of review comments from all locations, especially the remote area and field offices, and improve communications among designer, reviewer, and end user.

- The capacity to electronically store and sort large amounts of review data will allow comment files to be more readily analyzed and effectively used.

- The ability to generate a comment electronically and manipulate it with a few keystrokes will free the reviewer to concentrate on the review process instead of secretarial paperwork.

- The reviewer's ability to access comments generated by other review agencies will reduce duplication of effort and provide for a more comprehensive review.

ARMS has been demonstrated to a number of key individuals in the Corps, including several key Headquarters personnel in both engineering and construction. It has also been featured and demonstrated in the meetings of the Chiefs of the Engineering Divisions and the Chiefs of the Construction Divisions held in May 1989 at Orlando. All reviews have been very favorable. However, details of Corps-wide implementation were not addressed in these briefings.

The Army Audit Agency identified ARMS as a potential method for improving the Corps' review process. Further, the Engineer Inspector General has a strong

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interest in review management and in a recent inspection at the Sacramento District complimented the use of ARMS by the district. They projected that significant savings can be expected with the implementation of ARMS.

II. Scope and Objectives

The principal objective of this study was to examine whether the Corps should adopt the Automated Review Management System developed by CERL and tested by the Sacramento District as a Corps-wide system. Further, if the study concluded that such an action is desirable, recommendations on how to implement the solution would be provided.

The study was extended to look at two other review management systems currently used in the Corps, the Comment Network (COMNET) system developed by the Omaha District, and the DOCFR system developed by the Medical Review Group in Headquarters.

The study included the use of the system for both Military and Civil Works projects.

III. Study Approach

The approach used in this study to achieve the objectives consisted of the following steps:

- Form a field task group consisting of members from the field offices, laboratories, and Headquarters.

- Have developers of systems (CERL, CESPK, Omaha District, Medical Review Group) brief the task group on their respective systems.

- Independently evaluate the merits of adopting a system for Corps-wide use.

- Make consensus recommendations to Headquarters.

The task group consisted of the following members:

Dr. N. Radhakrishnan, CEWES-IM-Z, Chairman

Mr. Hugh Adams, CEMP-ES

Mr. Robert Chesi, CEMP-CE

Mr. Jim Goering, CEMRK-ED

Mr. Jeff Kirby, CECER-FS

Mr. Joe Rogers, CESAS-EN

Dr. Hugh Sharp, CEHND-ED-ES

Mr. Steve Stoner, CESPK-ED-T

Mr. Jim Vandersand, CESWF-ED-D

The group was briefed by Mr. Jeff Kirby and Mr. Steve Stoner on the ARMS systems, Mr. Bruce Dains, CEMP-EM, on the DOCFR system, and by Mr. Jerry Smith, CEMRD-ED-C, and Mr. Peter Olcott, CEMRO-ED-M, on the COMNET system.

IV. Study Findings

The study team quickly agreed that automated review management is a step in the right direction due to various reasons, including:

- Timeliness of review due to tracking.
- Higher quality of reviews due to monitoring.
- Better communications between designer, reviewer, and end user.
- Data base can allow sorting and analysis of comments.
- Less duplication of effort since reviewers can look at other comments.
- Reduced paperwork.
- Satisfaction for reviewers in knowing how their comments were dispensed with.

Most of the discussions were concerned with the desirability of adopting a Corps-wide system and the implementation of such a system.

Although ARMS was the most comprehensive system reviewed by the group, two other systems are being used in the Corps. The oldest Corps system, DOCFR, was developed by the Medical Review Group in Headquarters. It has been in existence for several years and used by all A/E's involved in the design of medical facilities. DOCFR is written in dBase. A short description of DOCFR and its relationship to ARMS is given in Appendix B.

The other system is called COMNET and was developed by the Omaha District a year ago. COMNET is a PC-network-based system and is also written in dBASE. COMNET is only being used internally in the Omaha District (A/E's do not have access to the system now). A description of COMNET is provided in Appendix C and in Olcott and Gilbertson (1989).

The task group felt that both DOCFR and COMNET have some good features that can enhance ARMS. A technical group under the chairmanship of Mr. Bruce Dains and consisting of members from Omaha District, Sacramento District, North Central Division, Lower Mississippi Valley Division, CERL, and the US Army Engineer Waterways Experiment Station (WES) was asked to look into this issue and write specifications for the enhanced ARMS in three months time. The group will initially concentrate on standardizing entry (input) screen formats. Refinements and additions to the system will be made at a later date.

The task group agreed that for ARMS to be most productive, every Corps office must use it. That way customers such as the Air Force A/E's who have business with multiple Corps offices will derive maximum benefits and the Corps will present a single corporate look to the outside world.

While ARMS' effectiveness has been proven in the Military Projects area by the Sacramento District, no office has used it in the Civil Works area. It was felt that a pilot test should be undertaken in a Civil-Works-oriented district for this purpose. The North Central Division and a Lower Mississippi Valley Division District appear as good candidates. Use of ARMS in Civil Works may be delayed until such testing is completed.

The task group agreed that for ARMS to be used productively by all the field offices and their clients and A/E's, a support center is essential. Since Sacramento District has the most experience with ARMS, the task group felt that they should be tasked to be the Support Center. The consensus on the Support Center was that it should be small (about five members, predominately engineers) and should only act as a 'catalyst' for other offices to effectively use ARMS. In other words, each office using ARMS should be responsible and committed, with the Support Center providing only initial training and some hot-line support. The Support Center should only train the districts who in turn will train the other people (training the trainers). Costs for the Support Center (about $500k-600k/year when fully formed) must be funded directly by Headquarters. Each district should have an ARMS coordinator and should use their information management people for maintaining the system hardware.

The Support Center activities must be monitored closely by Headquarters. Particular attention must be paid to develop a management plan that addresses how the district will differentiate its own production work from the Support Center work. Headquarters should form a field executive group consisting of middle and upper level managers drawn from the field offices to monitor the activities of the Support Center.

Dr. Hugh Sharp, Huntsville Division, presented a dozen recommendations that he felt are needed for fielding Corps-wide standard systems. They are based on years of experience in both automatic data processing and engineering and are worthy of review. They are included in Appendix D.

At the request of Dr. Radhakrishnan, Mr. Steve Stoner presented Sacramento District's testing of UNIX PC's to run ARMS. It was concluded that it is feasible to run ARMS on a 386 UNIX-based PC (costing about $15,000 for the entire system). This avenue must be further investigated as it will allow some small districts to use ARMS locally in PC's. The North Central Division will field test the recommended system and report the findings.

The task group felt that using ARMS in a central computer (be it Sacramento's UNISYS or WES/EASA's CEAP) will be inconvenient, expensive, and perhaps inappropriate for many districts. The UNIX PC option may be a good alternative but may not be suitable for all districts. It was decided that this issue must be revisited after the CEAP award is made and a final fielding configuration is known. Until that time districts should use either UNIX PC's locally (if NCD tests are successful) or should use Sacramento's UNISYS computer. A version of ARMS should also be converted to run in the pilot test machine at WES and made available free to users during the pilot test period.

If properly implemented, ARMS can be a valuable tool in Life Cycle Project Management. Timely and coordinated review can result in both cost and time savings on projects. Headquarters personnel should brief the Director of Civil Works and the Chiefs of the Project Management and Engineering Divisions, Civil Works Directorate, on ARMS as soon as possible and elicit their support. Strong Headquarters proponency from all elements (Military Programs and Civil Works, and Engineering and Construction) is essential for the successful fielding of ARMS.

V. Conclusions and Recommendations

Conclusions

The task group concluded that:

- The Corps can benefit from an automated review management system. The benefits in a military program environment, where the number of players is larger (the district, the division, the proponent service, the A/E, and the construction contractor), are more obvious and have been documented by the Sacramento District. The task group feels that benefits can be realized in the Civil Works projects but will be fewer due to a lesser number of participants (the district, the division, Headquarters, cost sharing partner (some cases), A/E, and the construction contractor) during the life cycle of the project.

- ARMS can strengthen the Life Cycle Project Management concept in at least two aspects. The systematic collection of review comments and their disposition from the feasibility stage through the design and construction phases of the project can accelerate the project as well as save costs. In addition, analysis of past comments can be useful in avoiding future mistakes.

- An automated review management system can provide optimum benefits only if implemented Corps-wide, at least for the Military Program projects. Piece-meal, optional implementation will create confusion among our customers (owners) and A/E's.

- Due to the large number of users involved and the varying computer literacy backgrounds, it is imperative that the system be kept very user friendly and training material be prepared that addresses both classroom training as well as other modes of training. Further, it is necessary to establish a small Support Center with about five members to provide training and hot-line support to the users.

- Headquarters must establish a strong proponency for this task and provide the field with proper guidance on the use of the system.

- A phased implementation of the system is necessary. Further, a Civil-Works-oriented district must be tasked to pilot test the system before adoption in the Civil Works projects.

- While the ARMS system developed by CERL and tested by the Sacramento District appeared as the most promising system, two other systems, one developed by the Omaha District (COMNET) and the other developed by the Medical Review Group (DOCFR), also had noteworthy features. Including some of these features in ARMS would make it a better system.

Recommendations

The following recommendations are made:

- The Corps should adopt ARMS as a Corps-wide system to be used in Military Program projects.

- Headquarters should fund a Civil Works district to pilot test ARMS. Based on this pilot test, a decision should be made in fielding ARMS in Civil Works projects.

- CEMP-ES should be designated as Headquarters' proponent of ARMS.

- A small ARMS Support Center consisting of about five members should be established at the Sacramento District. This Center will provide infrastructure support for the use of ARMS in the field offices. The Center should be small and function as a catalyst (much like the WES Computer-Aided Design and Drafting Center) for the effective use of ARMS in the districts. The responsibilities of the Center are discussed in the Management Plan included as Appendix E. Care should be taken to see that the support functions of the Center do not conflict or overlap with the operational functions of the Sacramento District.

- Use of ARMS in UNIX-based microcomputers should be further investigated. If successful, many districts may prefer to implement ARMS in this manner. The ARMS Support Center computer should be made available for any district wanting to test ARMS or wanting to use ARMS in a central computer.

- When the Corps' CEAP computers are deployed, ARMS fielding issues should be revisited.

- Every office using ARMS should designate an ARMS Project Coordinator who will take responsibility for the proper use of ARMS in the district's work.

- ARMS should be implemented in a phased manner.

- A new release of ARMS with the inclusion of some of the positive features of the two other existing review management systems (COMNET and DOCFR) should be developed within the next few months. A technical task group under the chairmanship of Mr. Bruce Dains and consisting of members from the Sacramento District, the Omaha District, CERL, WES, and other field offices should be formed immediately to write enhancement specifications for ARMS.

- A Field Technical Executive Group (FTEG) for computer-aided engineering should be formed to advise Headquarters on interdisciplinary computer application areas. This group should have members from the Civil Works and Military Program Directorate and the field offices. Headquarters may want to use this group to manage the activities of the ARMS Support Center as well as many other computer-related activities funded by Headquarters. FTEG can replace the current Corps of Engineers National Automation Team.

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Appendix A: Tasking Letters

REPLY TO
ATTENTION OF:

CEEC-ES

Brigadier General John F. Sobke
U.S. Army Engineering Division, South Pacific
630 Sansome Street, Room 720
San Francisco, California 94111-2206

Dear John:

This is to acknowledge your 3 May 1989 letter recommending that the ARMS program be fielded as a Corps-wide system. Automated management of review comments has great potential for reducing the number of change orders and improving product quality. We will carefully evaluate your proposal and make every effort to resolve the resource and standardization issues.

Since Corps-wide implementation will affect all of our districts and divisions, I believe that establishment of a task force with field representation is appropriate. Because review management is an integral part of the design process, I have asked Dr. N. Radhakrishnan who supervises the Computer Aided Engineering Division and CADD Support Center at WES, to form a task force to develop a plan of action. The plan must reflect an affordable fielding strategy acceptable to a large number of Corps offices.

We will keep you informed of our progress during the planning process. Our point of contact is Mr. Hugh Adams, CEEC-ES, Tel (202) 272-0232.

Sincerely,

Richard E. Hanson
Acting Director
Directorate of Engineering and
Construction

DEPARTMENT OF THE ARMY
SOUTH PACIFIC DIVISION, CORPS OF ENGINEERS
630 Sansome Street, Room 720
San Francisco, California 94111-2206

REPLY TO
ATTENTION OF

May 3, 1989

Office of the Division Engineer

Major General George R. Robertson
Directorate of Engineering
  and Construction
20 Massachusetts Avenue, N.W.
Washington, D.C. 20314-1000

Dear General Robertson:

Reference CESPK-ED-T (340 d) letter of April 24, 1989,
subject: Proposal for ARMS Technical Center of Expertise, with
enclosure (attached).

As you know, the Sacramento District is currently the center
of expertise for ARMS and I am very happy we could provide you
with a copy of the word processor used with the system and the
video tape used to train our Architect-Engineer's during your
visit in March. We have trained our customers in the use of the
system and fully implemented its use within the Division
boundaries. We have had successful results, especially with the
Air Force. However, because we have not proceeded to put the
system in place Corps-Wide there is a problem with some command
users only being able to take advantage of the system on SPD
projects while having to provide hard copy comments on all other
Corps designs. This is creating some dissatisfaction among these
users. I believe that this problem could be solved if ARMS were
declared an official Corps-Wide system.

I am enclosing a Sacramento District proposal to bring the
system on line Corps-Wide and request your consideration as a
means to achieve this goal. I understand that your Engineering
Staff (Herb Kennon) is now working jointly with your Construction
Staff (Dick Hansen) to bring about a quick transition to Corps-
Wide implementation. Another initiative being considered is to
install the ARMS system on the first CEAP computer to be
delivered; the one going to EASA. They would be requested to
maintain the system. There may be a better compromise
alternative that could come out of these two different proposals.
We would be glad to assist in any "task force" effort you might
want to make to develop a "Plan of Action" for achieving this
goal.
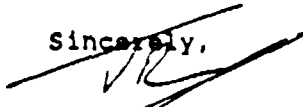
FACSIMILE HEADER SHEET
(ER 105-1-5)

FROM (NAME)	OFFICE SYMBOL	TELEPHONE NO.	RECEIVER'S SIGNATURE				
H. Adams	CEEC-ES	(202) 272-0232					
TO (NAME)	OFFICE SYMBOL	TELEPHONE NO.	PAGES	PRECEDENCE			DATE
N. Radhakrishnan	CEWES-IM-Z	(601) 634-2527	3	P			13 May
SUBJECT							

A4

Mr. Steve Stoner (CESPK-ED-T) is on the agenda of the Chief's of Construction meeting in Orlando in late May - where he will be presenting the latest on the ARMS program. Mr. Herb Kennon has also indicated he will be in attendance. I propose a meeting between E&C elements and CESPD representative at that meeting for the purpose of structuring a task force effort.

Sincerely,

John F. Sobke
Brigadier General, U.S. Army
Division Engineer

Enclosure

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT CORPS OF ENGINEERS
650 CAPITOL MALL
SACRAMENTO CALIFORNIA 95814 4794

REPLY TO
ATTENTION OF

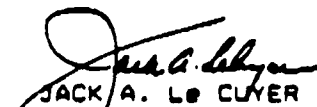CESPK-ED-T (340d)   24 April 1989

MEMORANDUM FOR Commander, South Pacific Division

SUBJECT: Proposal for ARMS Technical Center of Expertise

1.   Reference CESPD-ED Memorandum dated 18 Jan 89, subject: ARMS TCX.

2.   As requested in referenced Memorandum, we have examined our capability to establish and operate a Technical Center of Expertise (TCX) to support Nation-wide dissemination of the Automated Review Management System (ARMS). A detailed proposal to implement an ARMS TCX in Sacramento District is enclosed.

3.   In summary, the proposal reflects our belief that we have the necessary experience and expertise to successfully implement an ARMS TCX. We believe that the TCX could be operational by 1 Oct 89, given timely approval and funding. We would require 19 personnel slots to staff a TCX organization which could effectively field ARMS to all Corps FOAs in CONUS within two to three years. We recommend funding for the TCX be provided by the HQ USACE Engineering and Construction proponent.

4.   This proposal is the joint effort of, and is concurred in by IMO, RMO, PMO and Engineering Division. Your concurrence in this proposal and expeditious forwarding to HQ USACE for approval is requested. If you have questions regarding this proposal, please contact Mr. Steve Stoner at (916) 551-2318.

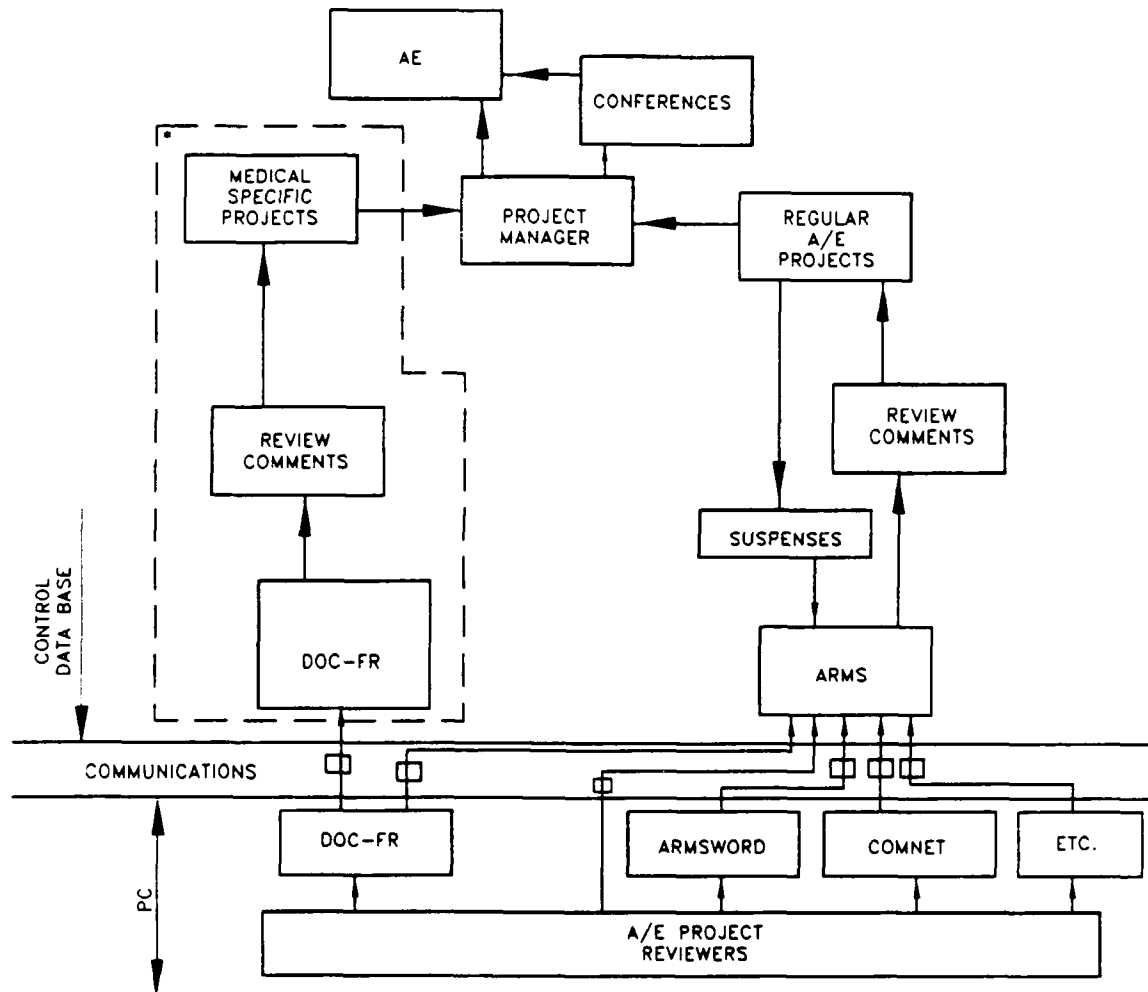Encl   JACK A. Le CUYER
                                                COL EN
                                                Commanding

Appendix B: DOCFR - Medical Review Group

System development for DOCFR was initiated in 1980. The first host for the system was a PDP minicomputer. At present the system runs on a PC under compiled dBase 3+. The Corps received the original mandate to review medical projects by Congress. Presently, the Medical Systems Branch is responsible for the design through the 35-percent stage. Six submittals are required (four until 35 percent, one at 65 percent, and one at 100 percent). A large number of comments are generated. At Madigan 5,000 comments were obtained at 35 percent and about 7,500 at 100 percent. Leo A. Daily is their architect/engineer support contractor. Initially, DOCFR comments were categorized via CSI. This was not found to be effective so their own classification scheme was developed. Personnel of the Medical Systems Office have eight years of experience running design review meetings and believe that DOCFR has been tailored to their needs. They are on Version 9.01 and usually have between 40 and 60 projects per year.

DOCFOR/ARMS INTERFACE DIAGRAM
REVEIW COMMENT FLOW
REGULAR A/E AND MEDICAL PROJECTS

```
                              ┌──────────┐
                              │    AE    │◄──────┐
                              └──────────┘   ┌───────────┐
    ┌ · ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┐    │        │CONFERENCES│
      ┌──────────┐              │        └───────────┘
    │ │ MEDICAL  │           │  │              │
      │ SPECIFIC │───────►┌──────────┐◄──┌───────────┐
    │ │ PROJECTS │        │ PROJECT  │   │  REGULAR  │
      └──────────┘        │ MANAGER  │   │    A/E    │
    │      ▲            │ └──────────┘   │ PROJECTS  │
           │                              └───────────┘
    │      │            │                      │    ▲
      ┌──────────┐                             │    │
    │ │  REVIEW  │      │               ┌───────────┐
      │ COMMENTS │                      │  REVIEW   │
    │ └──────────┘      │               │ COMMENTS  │
           ▲                            └───────────┘
    │      │            │                   ▼    ▲
           │                          ┌───────────┐
    │ ┌──────────┐      │             │ SUSPENSES │
      │          │                    └───────────┘
    │ │  DOC-FR  │      │                  │    ▲
      │          │                         ▼    │
    │ └──────────┘      │             ┌───────────┐
                                      │   ARMS    │
    └ ─ ─ ─│─ ─ ─ ─ ─ ─ ┘             └───────────┘
```

CONTROL DATA BASE

COMMUNICATIONS

PC

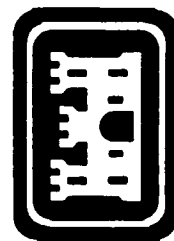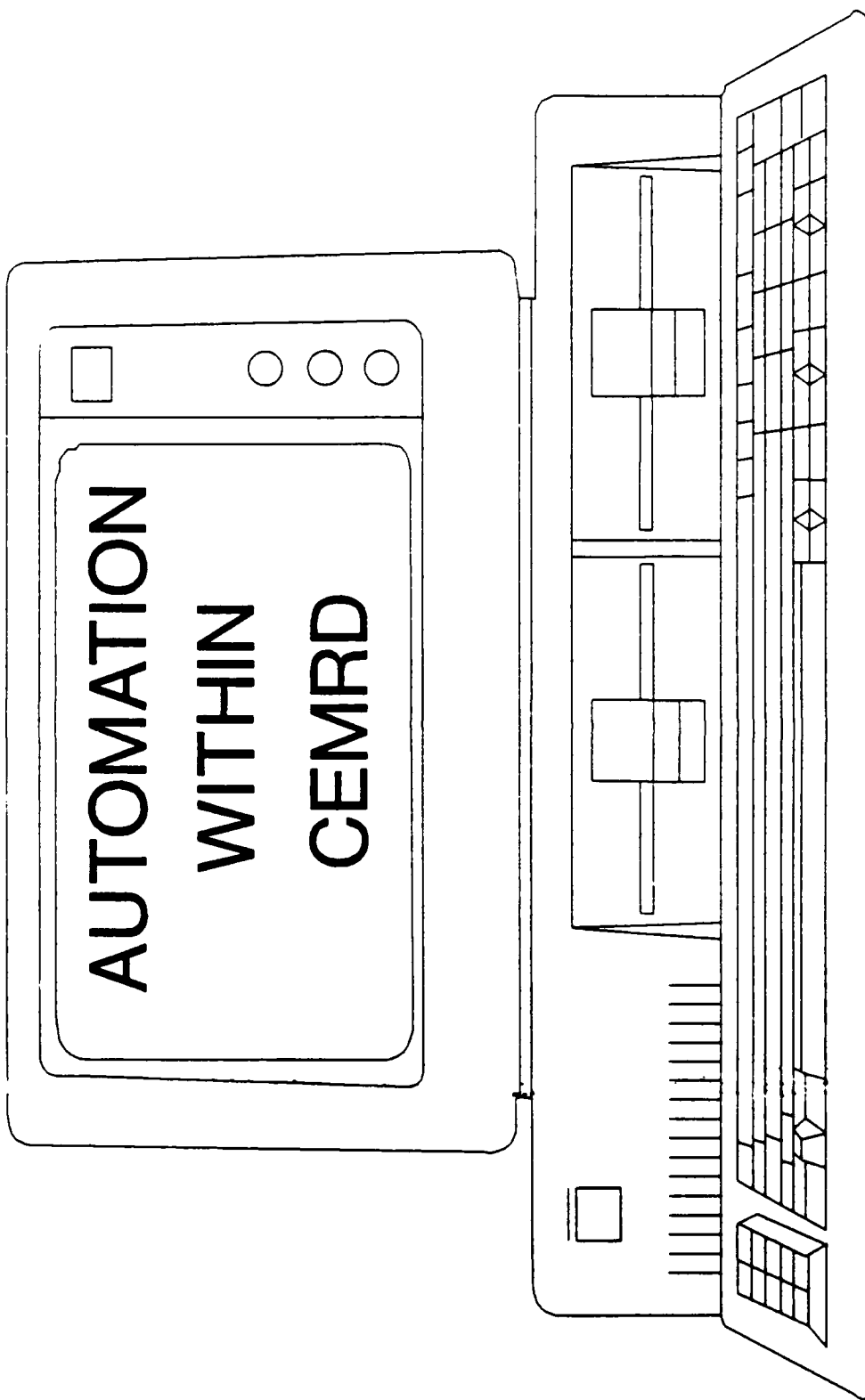| DOC-FR | | ARMSWORD | COMNET | ETC. |

| A/E PROJECT REVIEWERS |

• TEMPORARY UNTIL ARMS CAN BE ENHANCED
  TO PROVIDE MEDICAL PROJECT REQUIRED DATA AND REPORTS

Appendix C: COMNET - Omaha District
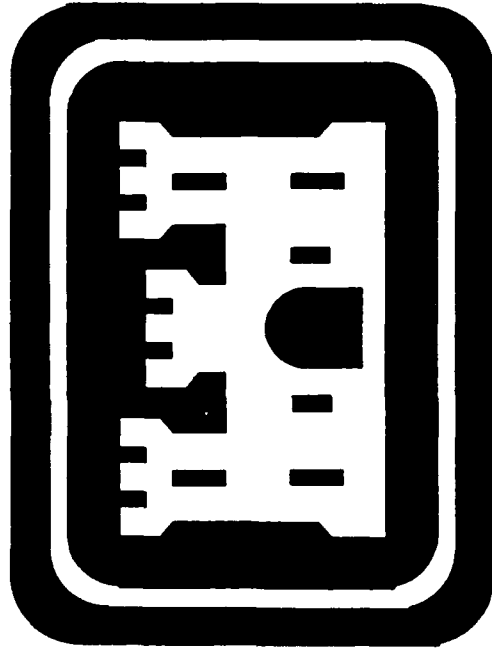
US ARMY CORPS
OF ENGINEERS
MISSOURI RIVER DIVISION

AUTOMATION WITHIN CEMRD

U.S. ARMY CORPS OF ENGINEERS
Missouri River Division

ARMS

WIDE AREA
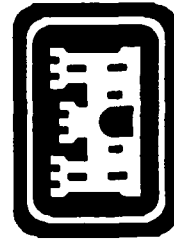## AUTOMATED REVIEW
MANAGEMENT SYSTEM

U.S. ARMY CORPS OF ENGINEERS
Missouri River Division

ARMS SYSTEM REQUIREMENTS

IBM PC (or look alike)

80286 BASED SYSTEM
640 KB RAM
40 MB HARD DISK

ACCESS TO 2400 BAUD MODEM
& PROCOMM FOR EACH PC

U.S. ARMY CORPS OF ENGINEERS
Missouri River Division

ARMS

ADVANTAGES

All Reviewers Have Access

Allows Simple Drawings

Central File for all
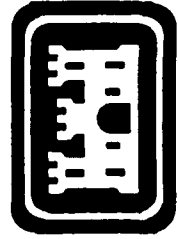Project Review Comments

DISADVANTAGES

Local Single User

No Local Central Database

No Local Standard Filename

No Local Management
Control/Review

U.S. ARMY CORPS OF ENGINEERS
Missouri River Division

C7

COMNET

LOCAL AUTOMATED
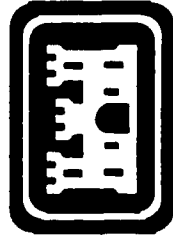## REVIEW COMMENT
MANAGEMENT SYSTEM

U.S. ARMY CORPS OF ENGINEERS
Missouri River Division

WHY COMNET?

FEWER RESOURCES

FASTER RESPONSE

ELIMINATES "MAIL TIME"

BETTER ACCOUNTABILITY

PRODUCTION INCREASE

DELAYS IN ARM'S DEVELOPMENT

U.S. ARMY CORPS OF ENGINEERS
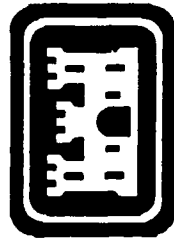Missouri River Division

COMNET SYSTEM REQUIREMENTS

LOCAL AREA NETWORK
W/100 M STORAGE

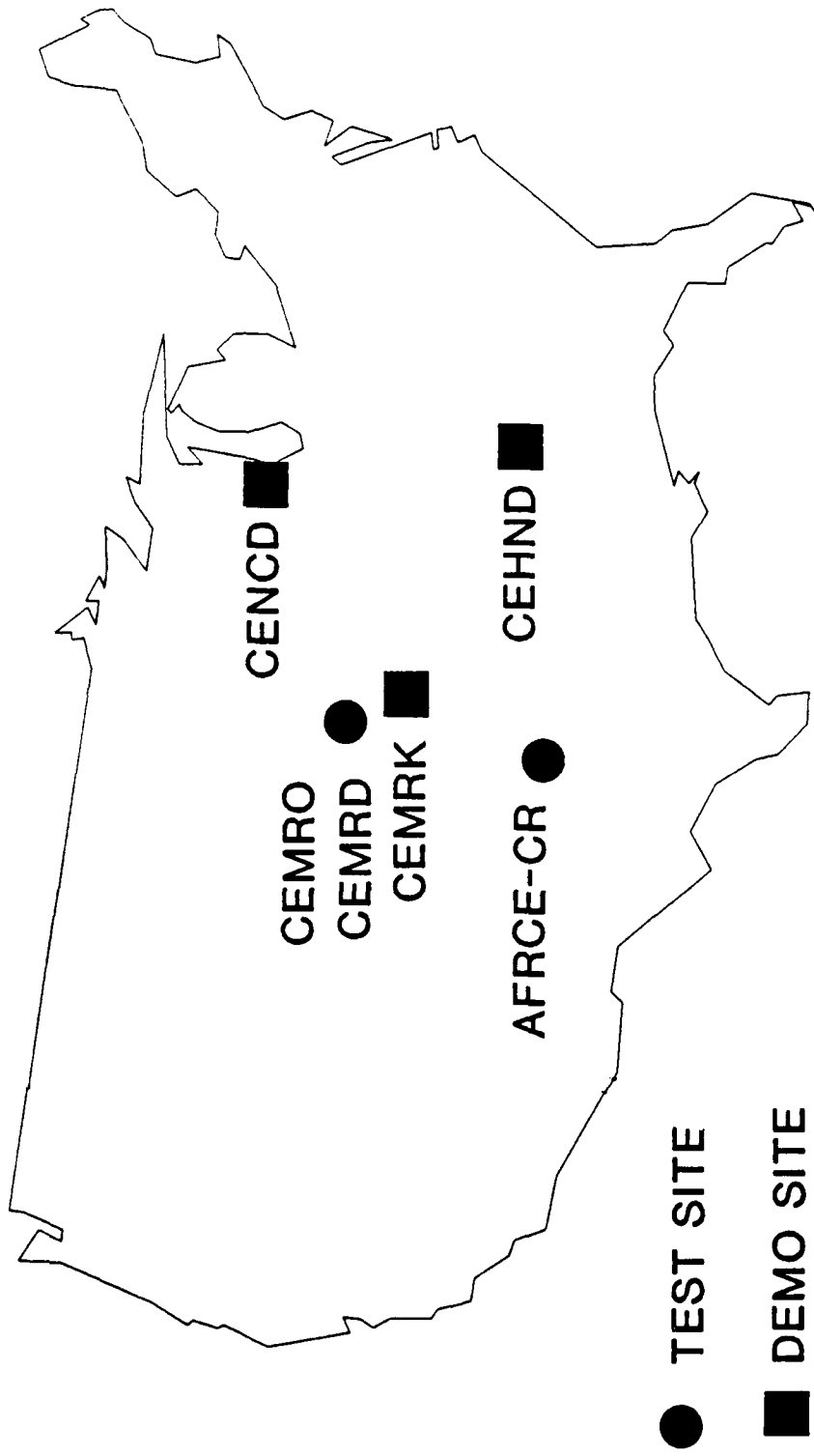25,000 Comments
150 Reviews.

DBASE III SOFTWARE

PC's FOR USER'S

COMMUNICATION FROM LAN
TO OTHER SYSTEMS
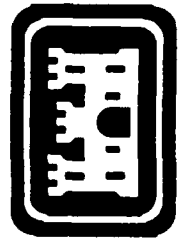
U.S. ARMY CORPS OF ENGINEERS
Missouri River Division

COMNET TEST & DEMONSTRATION SITES

CENCD

CEMRO
CEMRD
CEMRK

CEHND

AFRCE-CR

● TEST SITE

■ DEMO SITE

U.S. ARMY CORPS OF ENGINEERS
Missouri River Division

C11

COMNET FEEDBACK

System Easy to Use
May or May Not Accelerate Design Reviews
(Typing Skills Critical)

Improves Readability of Comments
Reduces Project Management Time
Accessibility of Computers Critical
Electronic Transfer of Data Critical
Improves Management of Design Reviews

U.S. ARMY CORPS OF ENGINEERS
Missouri River Division

C12

COMNET

ADVANTAGES

Local Central Database

Faster Response

Multi-User System

Local Management of
Comments Supported

Interface with ARMS

DISADVANTAGES

DIV/DIST only on
System

No Drawings

Multi-User System
Requires LAN

U.S. ARMY CORPS OF ENGINEERS
Missouri River Division

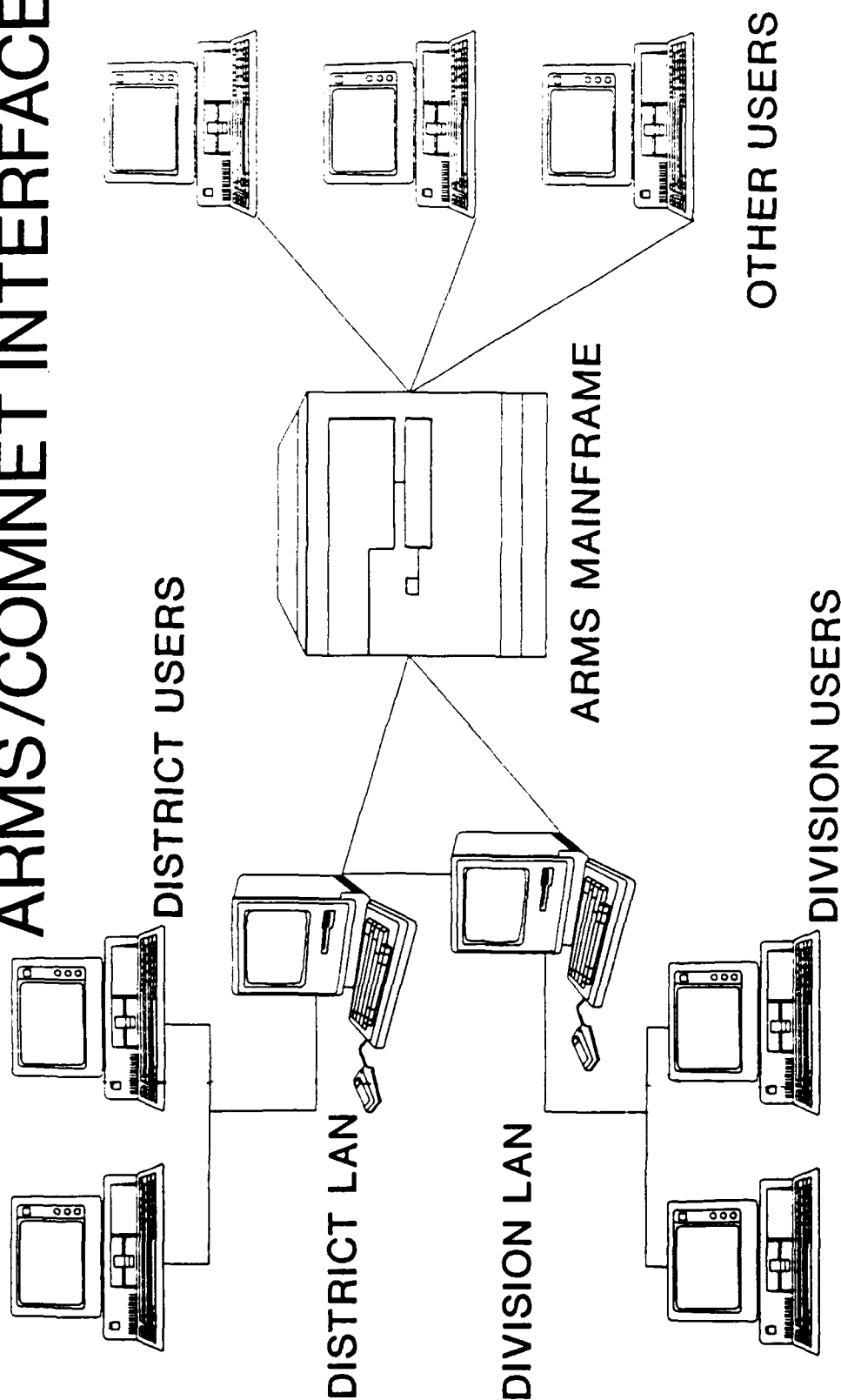# FUTURE COMNET DEVELOPMENTS

Improve Flexibility
Add Spellchecker
Allow for Sort by Page/Sheet Number
A/E Performance Evaluation
Secure Reviewer Comments

Interface with ARMS

U.S. ARMY CORPS OF ENGINEERS
Missouri River Division

ARMS/COMNET INTERFACE

OTHER USERS

ARMS MAINFRAME

DISTRICT USERS

DIVISION USERS

DISTRICT LAN

DIVISION LAN

U.S. ARMY CORPS OF ENGINEERS
Missouri River Division

C15

US Army Corps
of Engineers
Missouri River Division

GERALD (JERRY) SMITH, P.E.

CIVIL ENGINEER
COST & GENERAL ENGINEERING BRANCH
ENGINEERING DIVISION

(402) 221-7495
(FTS) 864-7495

12565 W. Center Rd.
ATTN: CEMRD-ED-C
Omaha, NE 68144-3869

C16

Appendix D: Critical Factors for Supporting Corps-wide Systems

by

Dr. Hugh Sharp
Huntsville Division

1. Remember that the Headquarters (HQ) proponent is most important. It is an absolute necessity that a strong proponent at HQ exists. This party must retain control of the system.

2. Know that a Management Plan (MP) is necessary. This plan must describe the system, the control to be exercised, and how the MP and the system will be modified over time.

3. Know that a team approach is necessary. The ideal mix is the system manager, the research and development (R&D) lab, and the assigned responsible agency (ARA) (functional as well as automatic data processing).

4. Perform a pilot test. It is necessary to demonstrate that the system does in fact work. The pilot test will also revalidate the need/use of the system.

5. Know the customer. Knowledge of the customer's needs will ensure the system does what it should. This end user information will also ensure that the system will be responsive.

6. Exploit ways to satisfy the customer's needs. Be flexible and creative in developing a solution.

7. Facilitate rather than direct implementation. Use the seductive approach. The key to success is making the customer want the system.

8. Maintain the in-house capability, but don't actually do programming. Use in-house resources to monitor contractor work. A small staff can effectively direct a large number of contractors. Use in-house staff for quality control of outside programmers. The 8A firms are often quite satisfactory.

9. Exploit automation initiatives. What you do is not necessarily the best. Use the MP to keep the system viable. The MP must change over time.

10. Balance progress and quality control. Big systems never get "ripe." Time to implement must be identified.

11. Do not make ARA the trainer. The Tech Monitor should review HQ issues. Plan to contract training as professionals do a much better job. The system documentator is a good choice. Prospect courses are typically not a good medium for system training as they are expensive and take up to a year to get in the system.

12. Secure management support. Strong support is needed from all team members: ARA, R&D, and local ARA's. Demonstrated enthusiasm is needed among the supporters. Recognition for the players is a must.

Appendix E: Draft Management Plan for the Support Center

<u>D R A F T</u>

Automated Review Management System
Management Plan

1. GENERAL

1.1 BACKGROUND

Responsibility for the Automated Review Management System (ARMS) resides with Headquarters, U.S. Army Corps of Engineers (HQUSACE). Portions of the functional responsibilities of the program will be transferred to the ARMS Technical Center of Expertise (TCX), Sacramento District (CESPK), Sacramento, CA.

1.2 PURPOSE

This management plan establishes relatonships, responsibilities, and procedures under which the ARMS TCX will assist HQUSACE in the management and execution of ARMS in accordance with the mission assignment.

1.3 SCOPE

1.3.1 This management plan broadly covers responsibilities and relationships between HQUSACE and ARMS TCX regarding the management and execution of ARMS.

1.3.2 The number and type of USACE Field Operating activities (CE FOA) involved includes those FOA desiring to establish and administer an automated review system within HQUSACE jurisdiction.

1.4 FUNCTIONS

1.4.1 HQUSACE functions include tasking ARMS TCX for the upcoming fiscal year; monitoring progress and participating in resolution of key technical issues; and approving policies and procedures governing operation of the ARMS TCX.

1.4.2 ARMS TCX facilitates the deployment and maintenance of ARMS as tasked by HQUSACE. Such work may include training in ARMS use, contract support, document development, hardware and software evaluation, coordination of ARMS activities, and identification and transfer of new technology.

2. ORGANIZATIONAL RELATIONSHIPS AND RESPONSIBILITIES

2.1 GENERAL

The purpose of this section is to define the general relationships and responsibilities of each of the participating activities.

2.2 PARTICIPANTS AND RESPONSIBILITIES

Corps of Engineers participants in this program include HQUSACE, CESPK, USACE laboratories (CE LAB), and CE FOA. All participants will follow the general relationships, responsibilities, and procedures outlined in this management plan.

2.3 HQUSACE

HQUSACE will execute the ARMS program throughout the Civil Works and Military Programs Directorates, through the Military Programs Directorate, Engineering Division, Engineering Management Branch (CEMP-ES). Responsibilities of CEMP-ES are:

    a. Overall program direction, control, and management to include:

        (1) broad policy guidance and setting program objectives

        (2) budget preparation and distribution of funds consistent with the priorities

        (3) overall program content, prioritization, and scheduling

        (4) managerial oversight of all branches of HQUSACE involved in automated reviews

        (5) providing program guidance to the CESPK - ARMS TCX

        (6) providing program guidance to all Division and District Commanders responsible for specific tasks

    b. Technical oversight, direction, review, and drafting key policy for controversial or unprecedented problems or regarding new technology.

    c. Selection of a FOA/Lab for execution of a particular task.

d. Forming Field Review Groups (FRG) in coordination with ARMS TCX to assist the technical proponent in reviewing progress and ensuring that products meet Corps-wide requirements.

e. Providing written tasking to ARMS TCX delineating specific requirements for each fiscal year. Tasks will include funding amounts and scopes of work.

CEMP-ES is the HQUSACE proponent for this program.

2.4 CESPK ARMS TCX

CESPK - ARMS TCX will assist HQUSACE in the management and execution of ARMS and will serve as the CE activity responsible for the administration of the program. ARMS TCX responsibilities are as follows:

a. Provide assistance in deployment scheduling, developing milestones and tracking task execution in accordance with HQUSACE guidance. Inform CEMP-ES of program progress as requested.

b. Prepare status reports covering FOA/Labs impleme FY.

d. Distribute reimbursable cost training documents to each HQUSACE branch and FOA/Labs.

e. Promote technology transfer efforts of each HQUSACE branch and FOA/Labs involved in automated review.

f. Prepare Management Operating Agreements between ARMS TCX and each HQUSACE branch and FOA/Labs involved in automated review.

g. Prepare the ARMS TCX Operating Charter.

h. Select and acquire contract support (contractors, university professors, consultants) including awarding and administration of contract when requested by HQUSACE.

i. After FOA decides to utilize the TCX, TCX staff trains FOA staff based on local review methods, and TCX staff trains FOA staff to train its own jurisdictional ARMS users.

j. Brief FOA project managers on methods of review and suggest initial local uses.

k. Provide software for FOA staff and local users for off-line generation of and response to comments.

l. Provide telephone hot-line support every working
day 0600 to 1800 PST.

m. TCX staff trains other Federal Agencies and Major
Command staff and support all users on questions concerning
the uses of ARMS via the ARMS hot-line.

n. Support ARMS User Group and provide access to the
Group's bulletin board for updates of Group activities.
lessons learned papers, ARMS manual updates and software.

o. Perform other assignments which are consistent
with the ARMS TCX mission and are requested by HQUSACE, FOA
or Labs.

2.5 USACE FOAs and LABs

CE FOAs and Labs will be responsible for supporting the
program as tasked by HQUSACE. Lab and FOA responsibilities
are as follows:

a. Be responsible for the timeliness. technical
accuracy. completeness and style of review comments that
they forward to the ARMS TCX program.

b. Assign a local ARMS liaison and all operational
elements shall be responsible to their local ARMS liaison
for efficient and appropriate use of the program. Any
conflicts will be referred to the ARMS TCX for resolution.

c. Assure that review suspense dates are met.

d. In case of a district FOA, keep division office
informed of progress.

e. FOA train all local user agency reviewers and
support the local reviewers with information concerning a
project's review status.

f. Distribute self-paced training aids to local
review agencies.

g. Inclusion of new technology resulting from
research into the automated review process.

h. Performing and coordinating work with the CESPK -
ARMS TCX in accordance with HQUSACE guidance.

2.6 SUMMARY MATRIX OF RESPONSIBILITIES

The responsibilities of the participants are shown in matrix form in Table 1.

3. MANAGEMENT AND EXECUTION

3.1 HQUSACE MANAGEMENT PROCEDURE

3.1.1 CEMP-ES is the primary office for coordination of ARMS with CESPK - ARMS TCX. All official requests will be through CEMP-ES.

3.1.2 ARMS TCX will maintain a tracking system of HQUSACE events in automated review to include receipt of requests, resolution of issues, coordination within HQUSACE, and the training of FOA/Labs.

3.1.3 CEMP-ES will periodically arrange for an in-progress review meeting with ARMS TCX, HQUSACE proponents, and others as needed.

3.2 ARMS TCX MANAGEMENT PROCEDURE

3.2.1 ARMS TCX will assist HQUSACE as requested in the management and execution of ARMS.

3.2.2 ARMS TCX will distribute funds in accordance with HQUSACE guidance, track expenditures and track progress of each task; ARMS TCX will provide status of tasks to CEMP-ES at the in-progress review (IPR) meetings and at other times on an as-requested basis.

3.2.3 ARMS TCX will develop and maintain a state-of-the-art ARMS to assist HQUSACE in managing the program.

4. FUNDING

4.1 Funding to support the taskings identified in the annual program will be provided by HQUSACE. All major modifications must be approved by CEMP-ES. Exceptions will be approved by CEMP-ES on a case-by-case basis.

4.2 CESPK - ARMS TCX will be responsible for distribution of resources to CE FOAs/Labs.

TABLE 1 - MATRIX OF RESPONSIBILITIES

FUNCTIONS	HQUSACE	ARMS TCX	FOA/LAB
Program Policy	E	X	S
Program Management			
Priorities	A	X	S
Funding	A	X	S
Scheduling	E	X	E
Reports	E	X	S
Select Field			
Review Group	E	-	S
Selection & Tasking			
FOA/Labs	E	X	-
Select Contractors	A	E	-
Direction to ARMS TCX	E	X	-
Technical Monitoring	E	-	-
Reviews suspense dates	-	S	E/X
Management & Administration	E	X	S
Technical Approval	E	X	S
Training FOA/Labs	-	X	S
Training local users	-	S	X

Legend: A - Approve
          E - Establish & Oversight
          S - Support
          X - Execute

E8